The Newsletter of
Engineering Heritage Australia

No. 19 - March 2007

Australia's Lost Border

In 2005 Engineering Heritage, Canberra, launched the book "The Disputed Country – Australia's Lost Border" at the National Press Club. Bob Dunn's book tells the story of Australia's first surveyed border and the festering legal dispute which began soon after the survey was completed.

Begun in 1847, the South Australia - Victoria border survey began on the coast, where the churning waters of Discovery Bay strike the languid lagoon of the Glenelg River. From there, Henry Wade pushed north through waving coastal heath, majestic box and gum woodlands; then churned his way through the quagmire of Dismal Swamp, the sands of the Little Desert and northwards right to the edge of the olive-green sea of shimmering mallee scrub. Wade's Termination Point is near today's Bordertown.

Then in two separate expeditions in 1849 and 1850, his assistant Edward Riggs White hacked his way north through the Mallee Country of today's Big Desert and Ngarkat National Parks. Struggling in drought and staggering through furnace-like heat, he and his crew nearly perished from thirst, not once but three times.

Neither South Australia nor Victoria supplied the surveyors with metal survey monuments. For much of the time, they made do with timber posts surrounded by mounds of earth and sand. Only at the very start and end of the line could cairns of stones be erected. That was the problem because in February of 1851, the largest bushfire ever seen hit Australia. Fully one-fifth of the new colony of Victoria was incinerated, while ships at sea almost capsized and burned from the embers of the cyclonic firestorm.

Ironically, White and his crew were still in the scrub, just putting the finishing touches to their surveyed line when the flames swept through the Mallee Country. It was all gone in a matter of an hour. With the timber marker posts destroyed and the scrub burnt, Mother Nature reclaimed all the hard work. The location of approximately 250 km of the line was lost, from Wade's Termination Point to the Murray River.

By 1868, accurate time signals were available over the newly constructed telegraph line and astronomical observations confirmed what had already been

Opened on 11 December 2001, a memorial to Henry Wade and Edward Riggs White stands on the road between Nelson, Victoria and Mt Gambier, South Australia.

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Engineering Heritage in the Wider Context

Engineering heritage is part of what is generally regarded as the historical stream of heritage conservation, and more broadly as part of cultural heritage. It is concerned with industrial places and structures, services and machines that have been designed by engineers or contribute to our engineering knowledge and technological progress. Whilst most engineering heritage stems from the time of industrial revolution and subsequent developments, along with the development of engineering as a profession, we are also interested in more ancient ideas and developments such as roads, bridges waterways and machinery that contribute to our technology. Thus we have an interest in Aboriginal heritage in relation to the development of indigenous Australian technology, including Aboriginal fish traps and aerodynamics of boomerangs, to mention two examples. Our use of engineering technology also impacts on the natural environment through the design and construction of roads, dams, power stations, airports and other infrastructure that is regarded as

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Engineering Heritage in the Wider Context

essential to modern civilisation. How we celebrate past technological achievements and appreciate past mistakes has a real bearing on how we as a profession approach the future.

National Cultural Heritage Forum

In our endeavours to understand and conserve engineering heritage, we have some different perspectives, but much in common with other heritage professionals. Along with historians, architects, archaeologists and heritage managers we follow the Burra Charter of Australia ICOMOS, and we contribute to a common understanding through our membership and participation in the National Cultural Heritage Forum (NCHF). This body has been established for a decade to advise successive Federal Heritage Ministers. In cooperation with the Department of Environment and Heritage, State Heritage Chairs and Officials, and a wide range of non-government heritage organisations, we meet several times a year to discuss issues and develop a vision to share with government.

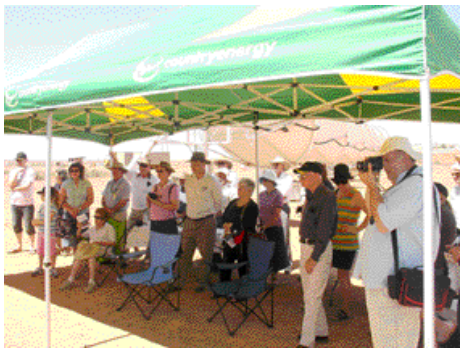
Productivity Commission Inquiry into Historic Heritage

The big issue for the NCHF in 2005-06 was the Productivity Commission Inquiry into Historic Heritage. After being convinced by a previous Minister that such an inquiry would benefit the heritage movement by quantifying the costs and benefits as a necessary step to justifying conservation funding, heritage NGOs, government organisations and the public contributed enthusiastically. EHA made three written submissions and four oral representations to the committee, which received 192 submissions and held 10 public hearings around Australia. But the Commission's draft report issued in December 2005 was controversial and extremely disappointing, not only to EHA, but to all the organisations participating in the NCHF. Shortcomings included a disregard for established national and international heritage procedures, an over-emphasis on private property rights to the detriment of public good, failure to provide an effective method of protecting places based on their heritage significance, and absence of balanced recommendations for determining and allocating government funding. In spite of the evidence provided in the submissions the draft report selectively quoted minority views that supported its economic rationalist conclusions, and completely ignored the submissions from EHA about any specific issues relating to engineering and industrial heritage. NCHF met with the Productivity Commission Members to acknowledge the value of the evidence collected, to clarify what we saw as misunderstandings, particularly relating to assessment of heritage significance, place listing and site management, and to debate the conclusions that had been drawn. The final report to the Federal Treasurer in April 2006 made token acknowledgment of the points discussed with the NCHF, but little of substance was changed. The shared views of the heritage NGOs were subsequently expressed in a formal NCHF meeting with Environment and Heritage Minister Campbell, and in NCHF and EHA letters to Treasurer Costello. It is yet to be seen whether the recommendations of the report will further see the light of day or remain on the Treasurer's shelf. However NCHF has taken the step of analysing the submissions to improve our common understanding and to strengthen the case for better protection and conservation of the Nation's cultural heritage.

Keith Baker
Immediate Past Chair EHA

HEM Plaque Unveiled at White Cliffs Solar Power Station

In an event that questions the view on what 'historic' means, the National President of Engineers Australia, Mr Peter Cockbain, unveiled a Historic Engineering Marker at the White Cliffs Solar Power Station on 11 October 2006, only 25 years after the construction of what was arguably the first commercial solar power station in the world.



The assembled guests with some of the dishes in the background

"Today, the White Cliffs solar power station becomes the most contemporary asset to be plaqued by Engineers Australia. In this, the 25th anniversary year of its construction, we are reminded that something does not have to be very 'old' to be of engineering heritage significance." explained Mr Cockbain.

In his speech at the unveiling ceremony, Guy Chick from Country Energy spoke of the important social and educational role the power station has played in White Cliffs and the wider community. "From the time White Cliffs was chosen as the site for a Solar Power station, a 'relationship' between the town and the facility was quickly established. The rows of shining dishes quickly became an identifying 'icon' for the town" said Chick. The power station brought the first reticulated power supply to the remote western NSW township.

Amongst the invited guests present at the ceremony were many of the pioneering engineers and scientists involved in the design, construction and operation of the Power Station over the years. These included Emeritus Professor Stephen Kaneff from the Australian National University, who designed the original solar thermal system. Also present were representatives from Solar Systems, the Melbourne based company responsible for converting the station to a concentrating photovoltaic system in 1997.

Original 1981 Thermal System

The story of the White Cliffs solar power station is really a story in two parts; the original station was established by ANU researchers as an experimental facility with funding from the NSW State Government (Energy Authority of NSW). Commenced in 1981 at a final cost totalled nearly $1.9 million, the power station comprised fourteen sun tracking parabolic dishes of 5 metres diameter (two rows of seven), each concentrating the suns rays onto a thermal absorber at its focal point to heat water to produce steam. The steam was piped back to a central heat exchanger to power a reciprocating steam engine generator that produced up to 25kW of electricity. Some of the energy was stored in batteries (to provide electricity at night) and a back-up diesel generator ensured supply during extended cloudy periods.

The electricity from the station was reticulated at low voltage (240 volts) over a limited area of the township, supplying the local hospital, school, post office and twelve homes. Because this electricity was 'sold' to these customers, this gives rise to the claim that White Cliffs was the "first commercial solar power station in the world". At the time there was no grid supply to White Cliffs and electricity was otherwise generated at individual dwellings by diesel generators.

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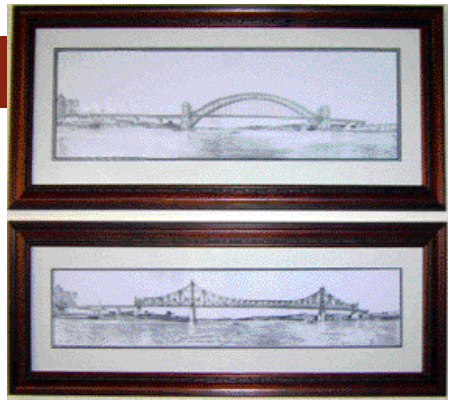
Comparing the View

The third of a regular column by EHA Chair, Keith Baker

Story Bridge, Brisbane



The JJC Bradfield 1922 drawings of alternative designs for Sydney Harbour Bridge presented to the National Office of Engineers Australia

Over recent months I have been intrigued by the progress of a balanced cantilever bridge being constructed over Belconnen Way, as the Gungahlin Drive Extension in Canberra takes shape. My fascination has been with the way that two heavily reinforced concrete columns emerged from the ground, then formed tee shaped arms which grew week by week as we drove under them. Eventually they joined in the middle and the outer ends reached the abutments that had risen on either side to keep up with progress. The growing concrete cantilevers appeared to be supported by steel structures above them, which in fact supported the formwork as concrete was poured. The strength of the bridge was really in the steel cables that were installed internally and tightened with each new section that was cast above ground.

You might ask what all this has to do with heritage! It was the first time in Australia this form of concrete construction had been used with VSL travelling formwork, so maybe some time in the future this might be regarded as of heritage significance. But cantilever bridges are not particularly new. The rail bridge over the Firth of Forth in Scotland was recognized as the world's largest cantilever bridge when it was constructed in 1890. The distinctive style of such steel bridges was to have a tower structure, from which the cantilevers emerged much higher than the road deck or railway they supported, allowing for steel structural members in tension to support the weight. This distinctive shape is evident in Brisbane's Story Bridge and many other steel cantilever bridges around the world.

While researching Sydney Harbour Bridge for a possible nomination to the National Heritage List I became aware that its designer, JJC Bradfield, had allowed an alternative design of a cantilever bridge for comparison with his preferred option of the now familiar arch. There can be little doubt the aesthetics of the arch bridge lend themselves more to Sydney Harbour, but Bradfield had his chance a few years later to build a shortened version of the cantilever option across the Brisbane River at Kangaroo point.

To add to this twisted story about bridges by an electrical engineer, we held our Board meeting of EHA in Canberra at Engineering House during the week that "my" concrete cantilevers had their final pour and joined in the middle. During that meeting we were given a preview of two beautifully famed prints of Bradfield's design drawings for Sydney Harbour: one of the arch bridge, and the other of what looked very much like a stretched Story Bridge. You can see these sometime when visiting National Office.

Keith Baker - Immediate Past Chair, EHA

Awarding Merit

The Award of Merit for Engineering Heritage program is continuing, with four awards presented in the last two years and a further two waiting for a suitable presentation opportunity. The award shows appreciation to members of Engineering Heritage Australia committees and groups and their supporters and collaborators.

This column celebrates two awards made in Tasmania.

Lindsay Whitham graduated in civil engineering from the University of Tasmania in 1940 and joined the Hydro-Electric Commission. He gained his Masters Degree and the Institution's Chapman Medal for his analytical work on the proposed Clark Dam. He retired in 1978 after a career in the investigation and design of iconic Tasmanian dams and hydro-electric projects.

Starting in 1967 Lindsay wrote sixteen papers which were published by the Tasmanian Historical Research Association in their quarterly journal. He chose subjects for which no comprehensive account already existed. The Association collected his papers into a book entitled *Railways, Mines, Pubs & People and other Historical Research.* Many of the papers in the book have significant engineering heritage content.

The chapter on the Bridgewater Bridge is an excellent example of his work. This is a major crossing of the Derwent River for the Hobart to Launceston highway and rail line. It currently consists of a long causeway and a lift span for river traffic. Lindsay has meticulously traced the history of the four successive bridges at the site.

Dick van der Molen studied aeronautical engineering during the war in Holland, joined the army in 1945, went to Indonesia in a reconstruction unit and, after demobilisation in 1950, emigrated to Australia. In his career he has been in private practice with Bechtel Pacific and Camp Scott & Furphy, and then in academia as Senior Lecturer in Concrete Technology and Design at the University of Melbourne, retiring in 1999.

Since the early 1990s Dick has been deeply involved in the structural assessment and the possibility of restoring the Barwon River Sewer Aqueduct at Geelong. This is a major historical reinforced concrete structure built in 1913-16. It has 14 spans and a total length of 750 m but some of the reinforcement is corroded. It is listed on the Victorian Heritage Register and the Register of the National Estate. Dick has carried out a structural analysis which showed that the structure is still safe; has served on various committees related to the aqueduct; appeared before an Independent Planning Inquiry in support of the aqueduct and undertaken a study tour in Western Europe on restoration techniques for reinforced concrete heritage structures, reporting his findings to Heritage Victoria.

In 2000 Dick moved to Hobart and joined Engineering Heritage Tasmania. There he single-handedly restarted its national and local oral history programme, prepared the plaquing nomination for the Ross Bridge and contributed papers to two Engineering Heritage conferences.

Owen Peake

Continued from page 1 - Australia's Lost Border

suspected – that the border was too far west by 3.35 km. An acrimonious dispute began, with parochial South Australian politicians agitating for Victoria to give up this thin strip of land. The "Disputed Country" was born, the subject of claim and counter claim for 64 years.

Finally, in 1914, the Privy Council declared the border should stay exactly where it was originally marked out. But where is that? White's border posts were long lost and his survey books, thought to have been sent to London for the appeal hearings, have never been found. Today, more than a century and a half after it was marked out, the precise location of the top half of South Australia's border remains a mystery.

Being Australia's first surveyed border, Wade's and White's Line has solid heritage value and the two state Surveyors-General should re-establish and re-mark White's Line. There's not a lot of reference points from which to work, but White's final stone cairn still lies on the south bank of the Murray and there are documented references by a couple of early surveyors to remnants of border mounds further south. Wade's Termination Point lies on the southern edge of the mallee. Taken together, these reference points provide enough evidence for the line to be re-established. It's the sort of job surveyors-general are paid to do.

Once permanent markers are in place, Australia's first surveyed border surely deserves state heritage listing.

Bob Dunn
Engineering Heritage Canberra
September 2006

***"The Disputed Country – Australia's Lost Border"* is available from the distributors – Westprint Heritage Maps, Pty Ltd**
03 5391 1466
www.westprint.com.au

Historic Engineering Marker for Duck Reach Power Scheme in Tasmania

This hydro-electric power scheme was built by the Launceston City Council in 1895 to provide electric lights for the city streets and to supply electric motors for industry. It brought to an end 40 years of gas lighting.

With an initial capacity of 360 kW, the station generated both direct current for arc lights and alternating current for incandescent lamps. Impressed by the brightness, many residents quickly signed up for lights in their houses.

Sited on the South Esk River which flows down Launceston's famous gorge, the scheme consisted of low weirs across the river at Duck Reach, a tunnel across a major bend in the river and an iron penstock down the steep hillside to the power station on the river bank. Several power lines carried the dual output to a distribution station in the city.

The scheme was a major undertaking for the Council, and its approval involved a plebiscite of ratepayers. It was City Engineer Charles David's idea to build the tunnel instead of a long pipeline following the river around the bend. He said a tunnel would be maintenance free whereas the pipe would be subject to damage from falling rocks and trees. He demonstrated through a trial that a tunnel could be constructed for a similar cost despite the hardness of dolerite rock. Charles David looked after all the civil works.

K L Murray, formerly chief electrical engineer of the Victorian Railways, was responsible for the purchase and installation of the generating equipment and the distribution system. He ordered five 12 kW direct current generators and three 100 kW alternators. Gilbert Gilkes of Kendall, UK supplied the turbines and Siemens Bros of London produced the generators.

Duck Reach Power Station c.1905

Such was the demand for power that two more 100 kW machines were added in 1899, only to be replaced by four 300 kW machines in 1905 when the whole station was converted to three phase AC under City Electrical Engineer William Corin. A second penstock was installed to deliver the additional water. Another expansion was completed in 1921, bringing its installed capacity to 2000 kW.

Disaster struck in 1929 when an unprecedented flood demolished the power station building (and caused extensive damage in Launceston). The Council quickly rebuilt the station and recommissioned it in 1930. The scheme was compulsorily acquired by the Hydro-Electric Commission in 1944 and closed in 1955 when the larger Trevallyn Power Development harnessed the full capacity of the river.

Whilst most of the civil works remain, the generating equipment was removed and the building fell into disrepair. Repairs were carried out in 1995 and one machine reinstalled as a static exhibit. It is open to visitors daily and interpretive signs display its former glory.

On 7th October 2006 Engineers Australia presented a Historic Engineering Marker plaque to the Launceston City Council for the Duck Reach Power Scheme.

The plaquing ceremony was held in the foundry area (now a coffee shop) of the former Launceston Railway Workshops at Inveresk, now the home of the Queen Victoria Museum and Art Gallery. Overhead was a travelling crane and there was a furnace beside the podium. The audience of 70 people included engineers, historians, politicians and aldermen.

Tony Lee described the scheme and the engineers who designed and supervised its construction. Tasmania Division President Dan O'Toole outlined the plaquing program and presented the plaque. The Governor, having spoken earlier, unveiled the bronze plaque and Mayor Ivan Dean undertook to have it mounted in the power station.

After a quick lunch, Graeme Dineen (whose grandfather used to run the power station) led the VIPs on a guided tour, closely followed by 35 attendees in a bus kindly provided by Metro Tasmania. They walked across the suspension bridge to the station where the tunnel, two pipelines, the power house and one small machine remain.

Altogether it was a very successful event, with TV interviews being shown by Southern Cross and the ABC.

NOTE: A more detailed account of the scheme written by Miles Pearce will appear in the next issue of the Australian Journal of Electrical and Electronic Engineering.

Bruce Cole

John Monash Medal 2006 for Harry Trueman

Engineering Heritage Australia (EHA) has awarded the 2006 John Monash Medal to E G (Harry) Trueman FIEAust CPEng for his outstanding contribution to the conservation of engineering heritage.

National President Peter Cockbain presents Harry Trueman with his award at the 2006 AGM

During more than 20 years of active service on Sydney Division's Engineering Heritage Committee, Harry Trueman was Secretary of the organising committee for the 1988 Engineering Heritage Conference and went on the chair the Heritage Committee in 1989 and 1990.

Joining the National Committee on Engineering Heritage (now Engineering Heritage Australia) in 1989, Harry wrote the *Engineering Heritage & Conservation Guidelines* published in 1992. He edited the *EHA Newsletter* for six years, chaired EHA in 1999 and 2000, and convened the group that revised the *Guide to the Historic Engineering Plaquing Program* in 2003-04. He established the EHA website and continues to manage the EHA Email Forum.

He has been successful in promoting engineering heritage in the public arena through a range of important organisations including the NSW Heritage Office, the Australian Heritage Commission, the National Trust, Sydney Water, the Roads & Traffic Authority (NSW), the Sydney Opera House Conservation Council and the University of Sydney.

He has been instrumental in conserving many historic structures, especially the highly visible Pyrmont Bridge in Darling Harbour which was scheduled for demolition.

Harry has published a number of papers dealing with timber bridges and a prize-winning one on the restoration of the historic earthquake-damaged Christ Church Cathedral in Newcastle.

In 2004 he was presented with the inaugural Lifetime Achievement award as part of the NSW Government Heritage Volunteer Awards. It recognised his outstanding contribution to the field of engineering heritage in NSW in both a professional and voluntary capacity.

National President Peter Cockbain presented Harry with his award at Engineers Australia's AGM in November 2006.

EHA Is Not Alone!

The Newcomen Society celebrated the 200th anniversary of the birth of Isambard Kingdom Brunel (IKB) with a Brunel Bicentenary Conference in mid 2006. The June 2006 edition of their bulletin "LINKS" was largely devoted to Brunel stories.

Professor R Angus Buchanan (remembered by many as the keynote speaker at the 1992 Hobart conference – Ed.), the leading engineering heritage academic from Bath, England posed the question "IKB – The Greatest Engineer?" and proceeded, in a three-page article, to demonstrate that Brunel did in fact warrant such a claim. Buchanan did not attempt to make any claim about Brunel's greatest work but catalogued all his major achievements. The first was his work on the Great Western Railway (GWR). The "Railway Age" was at a very early stage of development when Brunel took up the GWR project with his usual gusto. Brunel took decisions which set standards which even modern railways struggle to reach – he was passionate about levelling the grades on track work resulting in great bridge and tunnel works on the lines (most of which are still in service today after 170 years) and he adopted the seven-foot broad gauge which did not survive but which is still the "gold standard" for smoothness of train ride.

Brunel then tackled the building of three iconic steam ships – The *Great Western* (first steam ship to operate a regular trans-Atlantic service), the *Great Britain* (first large iron ship and first successful screw-propelled ship, it changed the way ships were built forever) and the huge *Great Eastern* which remained the largest ship in the world for over four decades.

But there was more. Brunel built several major harbours, including Bristol, and many bridges, none of which is a better memorial to him that the beautiful Royal Albert Bridge at Saltash (near Plymouth) in Cornwall. This railway bridge, still in service, has two central spans of 142 metres over the Tamar River estuary consisting of curved iron tubes supporting the deck. However perhaps his greatest contribution to bridge-building was the wrought iron lattice-girder construction which he pioneered but which was not taken up early as he lived in an era of more decorative constructions and he was aware that Queen Victoria was judgmentally silent about his girder bridges. Later, railway builders would take up the functional and robust girder bridge in vast numbers.

Perhaps members of Engineers Australia should remember Brunel most for his strong views on the profession of engineering. He supported a single institution representing the profession and was a committed member of the Institution of Civil Engineers. In 1847, when the Institution of Mechanical Engineers was formed he commented "I fear it would tend to create a division in our Institution of Engineers, and so far I think would be open to objection". Brunel would have approved of Engineers Australia!

Owen Peake

Continued from page 2 - HEM Plaque Unveiled at White Cliffs Solar Power Station

1997 photovoltaic system

In 1997, Melbourne company Solar Systems converted the site to a concentrator photovoltaic (CPV) system. The dishes were re-surfaced with new mirrors and the thermal collectors were each replaced by a cluster of 16 photovoltaic cells which were more than 22% efficient in converting solar radiation directly into electricity. Water was still required at the focal point to cool the photovoltaic cells and maintain their efficiency.

The new system produced up to 42kW peak output, which was fed directly into the electricity grid (which now supplied the township), removing the need for batteries and the diesel backup. A new control system provided improved sun tracking, power optimisation and local and remote control.

The White Cliffs power plant was both the first commercial solar dish concentrator power plant and also the first solar concentrator photovoltaic (CPV) plant in the world. The power station represents early Australian innovation that has played a part in the development of the world's most efficient solar power technology.

Solar Systems demonstrated world record performance at White Cliffs in 1998. During that year, 'dish 2' at White Cliffs recorded a world record efficiency of 20%. This was an important stepping-stone towards present efficiencies, which are approaching 30%. The present generation of this technology is now commercially operating in central Australia at ten times the scale of the White Cliffs operation.

In its last full year of operation (2003-2004) the power station generated 35,412 kWh of electricity. The Station ceased generating into the grid in January 2005.

Lyndon Tilbrook from material provided by Chris Dalitz

A Peake at Steam

Steam-driven Sugar Mills in Java

In July and August of 2006 the International Stationary Steam Engine Society (ISSES), arranged a technical tour of sugar mills in Java. Eight participants plus a guide set off from Jakarta Airport for an intensive 14 day tour which provided a unique opportunity to visit 27 sugar mills between Cirebon in Central Java and Situbondo in the far east of Java.

There are about 30 sugar mills (out of a total of 58 currently operating in Java) which still contain operating reciprocating steam engines. Much of this machinery is very old, some going back to the 1880's and most having been made in the first 30 years of the twentieth century under Dutch colonial rule.

Today what is left is a real mixture: some mills have almost all of their original steam machinery; others have been partially modernised. For instance, several mills visited had the main crushing machinery converted to steam turbine drives, but elsewhere in the factory there were many reciprocating steam engines still at work.

What is most remarkable is that more than a century after many would have considered that the reciprocating steam engine was a superseded technology there are so many steam engines still hard at work making sugar for the people of Indonesia. Almost nobody in Java seems to think this is unusual. Teams of men in the sugar mills maintain the machinery with great skill and crude tools; operators drive the ancient engines with a casualness suggesting that this is the most normal occupation in the world. The men who manage these remarkable factories are modest and tolerant. While chaos reigns around them they remain calm and aloof from the heat, dust and noise and the sharp bursts of scalding steam which rush from worn shaft glands on old engines.

"Operators at Sumberharjo Mill pose with Stork mill engine No.1912 built in 1912. The blurred spokes of the flywheel behind the men show that the engine is running."

Here in Java old steam engines are very much still in full commercial service. They are being run, in their hundreds, twenty four hours a day, for months on end, as key parts of a complex industrial process which requires more brute force and sheer raw horsepower than most industries. The Java sugar mills are probably unique and we hope that they will survive to see many more crushing seasons, many more skilful running repairs, and continue to employ large numbers of proud Javanese workers.

Indonesia has long attempted to become self-sufficient in sugar production. In recent years the industry in Java has suffered from competition for land from other agricultural products which generate greater income for farmers than sugar cane and from the relative inefficiency of the old sugar mills which are small, by modern standards, and very labour intensive.

Production currently still lags behind demand by several million tonnes per annum. However new, more modern mills, on other islands where the land pressures are less intense, are being built and production is gradually overhauling demand. It is estimated that production in 2006 was around 1.8 million tonnes and consumption 3.7 million tonnes.

The large mill engines naturally get the most attention on visits like ours. These engines are generally large, single cylinder,

Three old vacuum pumps now on standby with steam engine driven generator operating in the background at Pagottan Mill

horizontal machines with a piston diameter of around 600mm and a stroke of typically 1000mm. Most were built between the end of the First World War and the late 1920s with the largest numbers being manufactured by two large Dutch manufacturers: Stork of Hengelo and Werkspoor of Amsterdam. In action these are impressive machines producing 500–800 horsepower at a fairly leisurely rotating speed of around 50–60 revolutions per minute. The engines have huge flywheels to help smooth out the fluctuating power needs of the mills as uneven quantities of cane are crushed to extract the sugar juice.

During the recent trip, huge amounts of data were collected, to add to that collected by others over many years, and thousands of photographs were taken. This emphasis on recording is a major part of the ISSES approach to Engineering Heritage.

During the trip we saw 518 steam engines. These consisted of 89 large mill engines; 102 vacuum pumps and air (or gas) compressors; 64 engines driving line shafting; 254 pumping engines and nine steam engines driving alternators in power houses. The number of engines actually in operation was not recorded and in any case is difficult to compute. Some engines are clearly kept in reserve to cover failures of other prime movers. Other engines, apparently in terminal condition, are probably waiting repair or a suitable replacement. Hence the distinction between "serviceable but not in operation", "under repair", "in reserve" and "derelict" is difficult to measure. The only meaningful measure we can make at this point is to say that the overwhelming majority of reciprocating steam engines were "running", truly a remarkable example of Engineering Heritage in action.

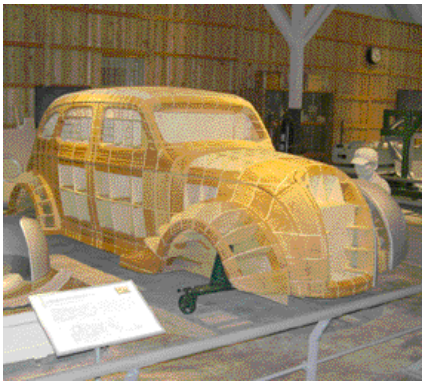
Owen Peake

The Toyota Commemorative Museum of Industry and Technology

The Commemorative Museum of Industry and Technology is located in Nagoya, Japan. It was established jointly by the 13 companies that make up the Toyota Group. The Museum is located at the site of the former Toyoda Spinning and Weaving Co. Ltd. headquarters plant, which was the place where the Toyota Group had its beginning. The building was thus preserved as a valuable industrial resource.

The Toyota Group originated from Sakichi Toyoda the inventor of the automatic loom and his oldest son Kiichiro Toyoda, who began production of looms and automobiles. Their aims were to pour all their strength into developing the economy and society through "making things" and through "being studious and creative".

Part of the Textile Machinery Pavilion showing Toyota's origins



How many companies have kept such a representative collection? (-Ed)

The Museum consists of two main parts, the Textile Machinery Pavilion and the Automobile Pavilion. The Textile Machinery Pavilion shows the history of textile manufacture with working machinery from early times powered by a water wheel and overhead line shafts to modern microprocessor controlled units. Machines are demonstrated by operators at different times during the day. The complexity of both the old and new machines is staggering and allows you to appreciate the technology behind the clothing we wear.

The Automobile Pavilion consists of the Materials Testing Centre, which is housed in one of the early timber buildings from the Toyota automobile plant which has been relocated to the museum, the Prototype Plant which shows how prototype cars are first made and Technoland which has some great interactive displays for all ages. However, the main part is the Automotive display hall which is a massive area where both old and new methods of manufacture are presented. There are several full size production lines in place showing the various processes in automobile manufacture. There are also very good interactive displays showing how engines, gearboxes, transmission systems, etc all work. There is also a demonstration area where metal cutting forging and casting are demonstrated.

The latest innovations are also on display including various robots that work through out the day, including one that plays the trumpet, and the new electric powered one person people mover that Toyota have been developing.

The museum allows the public to actually see the process of "making things" and celebrates engineering innovation. The whole presentation of the establishment shows a focus on the product and how it is made; the clear engineering messages have not been diluted by a non-engineer's "interpretation" as tends to be the case in the larger Australian museums. The engineer is presented as central to the advancement and well being of society, rather than being taken for granted.

A visit to The Commemorative Museum of Industry and Technology in Nagoya is highly recommended even if you little interest in textiles or automobiles. Allow at least half a day to have a good look, displays are multi-lingual including English. (By the way, you will notice that the company was originally called Toyoda, it was changed to Toyota for marketing reasons when they started in the automobile industry.

David Jehan

Lake Margaret Power Scheme Update

As foreshadowed in the last Newsletter, Hydro Tasmania closed down the power scheme on 1st July 2006. It is located near Queenstown on Tasmania's West Coast, and the station still has its seven original hydro-electric generating sets which have been operating since 1914.

In August Engineering Heritage Tasmania invited two Hydro Tasmania speakers to give a public lecture on the closure. Sandra Hogue described the Hydro's Cultural Heritage program which has carried out heritage assessments of the Corporation's 750 assets. Andrew Hickman then gave the reasons for the closure and explained the conservation measures being implemented to prevent deterioration of the scheme components while their future is being decided.

The heritage significance of the scheme is very high. It has provisional listing on the Tasmanian Heritage Register so that any work requires Heritage Council approval. It is being assessed for National Heritage Listing.

Redevelopment of the scheme has been addressed in Hydro Tasmania's Feasibility Study of December 2006. Its findings confirm that the 68 year old, 2.2 km long wood stave pipeline must be replaced and the options are either steel or wood stave, using Canadian yellow cedar. For the power station the economic choices are refurbishment of the original machines or a new single turbine outside the existing station.

There is considerable tourist potential for the scheme as other West Coast attractions bring many visitors to the region.

Hydro Tasmania has established a Community Liaison Group and invited public comment on the Feasibility Study until 27th February 2007. The report is available on the Hydro Tasmania website.

Recommissioning of the scheme will depend on the outcome of a business case and the ability of Hydro Tasmania to meet the cost. Severe competition for capital funds arises from the need to refurbish many other aging Hydro assets. If the station is closed for 3 years, the whole output (10 MW) would be eligible for renewable energy certificates.

Bruce Cole

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Book Review

With the issue of the second edition of *Rack Railways of Australia,* author David Jehan has updated the chapter on the Mount Lyell Mining and Railway Company's Queenstown to Regatta Point rack / adhesion railway in Tasmania to include details of the reconstruction of this railway. Readers may recall that this project was the recipient of an Australian Engineering Excellence Award in 2001 and, more recently in 2005, as the West Coast Wilderness Railway, was the recipient of the Colin Crisp Award.

The book commences with a chapter describing rack railway technology and the different rack systems which date back to the early days of self propelled steam engines when a rack and pinion drive was used to provide traction on a colliery railway between Middleton and Leeds in 1812. In this instance it was not the steep grades that determined the use of the rack drive but doubts about achieving adequate adhesion between wheel and rail. However, it was not until the 1860s that the first rack systems were developed to enable trains to negotiate the steep grades associated with the mountain railways then being constructed.

Subsequent chapters list in chronological order of construction, comprehensive details for the Mt Lyell Mining & Railway Company's Queenstown to Regatta Point rack / adhesion railway, the Queensland Government Railways' Kabra to Mount Morgan rack / adhesion railway, the Skitube rack railway in the Kosciusko National Park, and two industrial rack / adhesion railways in NSW. The first of these industrial railways was the Newcastle Wallsend Coal Company's Ellalong Colliery rack / adhesion underground railway. The second was the Blue Mountains Sewage Transfer System rack / adhesion underground construction railway which operated in the Lawson to Hazelbrook tunnel. The colliery railway was used to transport material underground and operated from 1984 until 2001 but the transfer tunnel railway only operated for a period of seven weeks during 1995. A further chapter with extensive details relating to the Dübs & Co. / North British Locomotive Ltd "ABT" rack / adhesion steam locomotives operated by the Tasmanian and Queensland operators is also included.

The Tasmanian and Queensland rack railways both began operating in the 1890s and continued in operation for some sixty years in the case of the Tasmanian line and fifty years for the Queensland line. Fortunately, the Queenstown to Strahan line was reconstructed and three of the original steam rack / adhesion locomotives have been restored resulting in an operation which is now a Tasmanian tourist icon.

The Skitube rack railway commenced operations in 1987 and the railway and rolling stock incorporates state of the art rack railway technology.

The author of *Railways of Australia* is a professional engineer and he has produced a well written book which is well illustrated with diagrams and photographs. It is a book which will be of interest not only to engineers, but also to railway historians and railway enthusiasts.

Rack Railways of Australia, published by the author David Jehan and distributed by the Illawarra Light Railway Museum Society. 112 pages.

John Brougham

Special offer to EHA Newsletter readers:
Rack Railways of Australia $20 per copy, including postage anywhere in Australia
Send cheque or money order to David Jehan, 44A Crump St., Mortdale, NSW, 2223.

Engineering Heritage Australia

2007 sees a new national board for Engineering Heritage Australia, made up of the following members:

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The plaquing committee in 2007 comprises Bruce Cole (chair), Malcolm Clark and Bill Oliver.

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